

ATTACHMENT E

Ruby Groundwater/Surface Water Interaction Model

Project Sponsor: Ruby Valley Conservation District

Contract Implementation Checklist:

_____ QAPP Notice to Proceed and DEQ Approval

_____ SAP Notice to Proceed and DEQ Approval

TASK 1 DESCRIPTION: MODFLOW MODELING AND FIELDWORK

Sub-task 1.1: Prepare MODFLOW Modeling QAPP

Sub-task 1.1 Description: Contractor will prepare a Quality Assurance Project Plan (QAPP) prior to commencing model development and simulation. The QAPP will be prepared following EPA's Guidance on Developing Quality Assurance Project Plans for Modeling Projects. The QAPP will include information on the calibration-validation criteria for the modeling exercise, objective functions used for model efficiency estimation, data quality objectives of the project, acceptable output criteria for hydrology mass-balance calibration, and other modeling-related quality assurance tenants. It may also be necessary to collect additional field/flow data for the effort. If this is the case, a Sampling and Analysis (SAP) plan will be developed to guide the data collection effort. This will be completed in accordance with DEQ requirements and must be approved prior to the initiation of the modeling effort.

Once the QAPP is approved by Montana DEQ, modeling will commence, as specified in sub tasks 1.2 part 1.3, to answer technical questions regarding water balance and provide predictive insight into how changes in water management will potentially affect the critical surface water features of the Ruby River and its tributaries and wetlands. The goal will be to refine the water budget through transient model runs to better understand the interaction of surface water and groundwater, as well as the management changes that affect the hydrologic balance of the area (e.g., irrigation efficiency, new groundwater supplies, changes in the vegetation cover, changes in irrigation water routing, increased growth, etc.).

A **Notice to Proceed Letter** will be issued for sub-task 1.2 after the DEQ has reviewed and approved the QAPP and associated planning documentation.

Sub-task 1.1 Deliverables: A QAPP detailing the proposed modeling effort.

Sub-task 1.1 Product Acceptance Criteria: DEQ approved QAPP. All documents in both hard copy and electronic format must comply with the Water Quality Planning Bureau (WQPB) Document Requirements incorporated into this agreement as Attachment C.

Sub-task 1.2: MODFLOW model setup, calibration, and validation

Sub-task 1.2 Description: Contractor will compile all requisite datasets for the MODFLOW simulation. The model will be setup to simulate groundwater discharge and stream flow at the key locations in the lower watershed and it will be calibrated to data collected and summarized in the Groundwater Management Plan for the Ruby River Watershed. This data includes: (1) pertinent GIS data, (2) well log and lithologic data, (3) pump test and hydraulic conductivity/transmissivity data, (4) well head summary and potentiometric surface information, (5) daily climate data, (6) Potential Evapotranspiration / Evapotranspiration data for various land covers in the Ruby River Watershed, (7) ditch transmission loss information, (8) water and consumptive use data, (9) in-stream flow information, and (10) any other pertinent data. This information will provide the necessary boundary conditions and inputs for the MODFLOW Model. They will be compiled for the entirety of the modeling domain.

MODFLOW and USGS SFR1 Surface Water Package will then be used to simulate groundwater discharge and stream flow at the key locations in the lower Ruby River watershed. Grid spacing and discretization of hydrologic features shall be adequate to define the level of detail necessary for understanding groundwater/surface water interaction in the Ruby River. This will be defined in cooperation with Montana DEQ. Once an adequate modeling framework is defined, the Contractor shall calibrate and validate MODFLOW results to observed well data. The techniques specified in the QAPP shall be used for this analysis, and include evaluation of root mean square error (RMS) of model residuals as well as graphical comparison of the observed and model-generated water levels. Additionally, this will include calibration results, statistics, and sensitivity analysis. The modeler will then develop annual Ruby River hydrographs in order to gauge the relative changes in flow and water levels for current conditions and predicted conditions. The results will be outlined in a detailed modeling report that will expand the current Groundwater Management Plan.

Sub-task 1.2 Deliverables: Sub-task 1-2 deliverables include (1) a calibrated MODFLOW model of specified locations in the Ruby River Watershed and (2) a modeling summary report that will form the basis of the final modeling report. The summary report should describe the calibration procedures and the results of the calibrated model in comparison to observed data.

Sub-task 1.2 Product Acceptance Criteria: A developed, functioning, and calibrated MODFLOW model with requisite model resolution to allow for analysis of surface water/groundwater interaction in the Ruby River Watershed. The deliverable will include a portable copy of the model burned to a CD. Specific reporting requirements for this task are included in sub-task 1.3. However, a summary memo should be included as part of sub-task 1.2 that describes the iterative calibration process, the parameters changed as part of the calibration, and the final calibrated model and modeling results (simulated hydrographs). This can be incorporated into the final modeling report at a later date. Both the GIS files and model will be submitted with an appropriate cover letter and supporting documentation. All documents in both hard copy and electronic format must comply with the Water Quality Planning Bureau (WQPB) Document Requirements incorporated into this agreement as Attachment C.

Sub-task 1.3: MODFLOW Modeling Report

Sub-task 1.3 Description: The final modeling report will be supplied both as a bound and hard copy document and will include the MODFLOW electronic models, associated grids and databases, and all project files on CD. The report itself will be developed as a separate MS Word document and will outline the development, calibration, and application of the calibrated MODFLOW model to existing conditions and modeled scenarios. Reporting will include the average annual/seasonal mass balance information.

The final report will incorporate all previous interim memoranda and correspondence, the datasets and assumptions used in the model development, calibration steps and methodology, and a comparison of model outputs to established modeling criteria. 1) an abstract, 2) table of contents, 3) introduction/background, 4) model overview and description of MODFLOW, 5) description of the model construction (grid spacing, discretization of hydrologic features, etc.), 6) calibration results, statistics, and sensitivity analysis, and 7) discussion of model results. The last section, discussion of model results, will include discussion of the steady-state base simulation, the effectiveness of using such models to simulate groundwater/surface water interactions from watersheds similar to that of the Ruby River, a discussion of the likely minimum required data to simulate other watersheds. Evaluation of the use of modeling will provide the basis for a discussion of application of such models elsewhere. A modeling journal will also be submitted describing any changes to model parameters during the model calibration process.

Sub-task 1.3 Deliverables: The deliverable of sub-task 1.3 will be a final modeling summary report that builds on the previous draft report (sub-task 1.2) and provides comprehensive information and documentation of the MODFLOW model setup, parameterization, calibration-verification, and existing condition

modeling. All final MODFLOW input-output files, GIS coverages, and associated information will be included as part of the final modeling report.

Sub-task 1.3 Product Acceptance Criteria: The final modeling report must be in MS Word format and sufficiently describe the model construction and calibration steps, including all assumptions and management file definitions applied for various hydrologic response units. In addition, the report will contain a comparison of the calibrated model outputs for hydrology and water quality loadings for nutrients, and sediment against observed data at all calibration points. The report and files will outline the predicted ramifications of land use changes related to irrigation efficiency, water conveyance, groundwater pumping, vegetation cover and climatic variations. All documents in both hard copy and electronic format must comply with the Water Quality Planning Bureau (WQPB) Document Requirements incorporated into this agreement as Attachment C.

Task 1 Costs: 319 funds \$61,496.00, Match \$16,404.00

Task 1 Time Line: Upon contract execution through June 30, 2008

Task 1 Outputs: Completion and acceptance of the three sub-tasks deliverables listed above. The final product will be available from the Ruby Valley Conservation District (RVCD) both on the web site at rvcd.org as well as on CD-ROM from the RVCD if requested by citizens and agency representatives. All products will be delivered to DEQ in both hard copy and electronic format and must comply with the Water Quality Planning Bureau (WQPB) Document Requirements incorporated into this agreement as Attachment C.

Task 1 Acceptance Criteria: Quality control, and assuring that the project will meet predetermined objectives, will be maintained by utilizing the Ruby Watershed Council (RWC) Technical committee and MDEQ will participate to ensure QAPP, model development, computer simulation, and reporting phases of this project are efficiently and effectively completed. . All documents in both hard copy and electronic format must comply with the Water Quality Planning Bureau (WQPB) Document Requirements incorporated into this agreement as Attachment C.

TASK 2: COORDINATE PUBLIC MEETINGS AND PRESENTATIONS OUTLINING THE COLLECTED DATA, THE RECOMMENDED RESTORATION STRATEGIES AND IDENTIFY/INITIATE PROJECTS.

Task 2 Description: Contractor will focus on specific education for this project and public outreach as well as linking education efforts to water quality issues currently being identified through the pending Water Quality Research Program (WQRP), Ruby Watershed Work Plan, and Lower Ruby Valley Groundwater Management Plan. Contractor will educate the public and interested stakeholders that this model will help to clarify and explain the gathered ground

and surface water data and provide information that is pertinent to local landowners, the public and many natural resource agencies. Contractor will present and disseminate the modeling interpretations to the public and agency personnel and collaborate with the community concerns to develop a long-range management plan for the water and land resources. The education component is part of a larger watershed education, planning and project effort of the Ruby Watershed Council. There will be at least two public meetings/presentations to inform the residents of the status of the project and the preliminary findings from the modeling. There will also be several public and one-on-one meetings to collaborate with willing landowners and stakeholders on identified and modeled project areas. The RWC will also present the results to other watershed and interested groups. The In-Kind match for this task is representative of the volunteer hours associated with the Council members and technical committee members and their time spent involved in the meetings and project implementation. The In-kind also represents a large amount of time and effort from the Madison County Planning staff and board.

Task 2 Costs: 319 funds: **\$5,000.00**, Other funds: \$38,000.00

Task 2 Time Line: (See Master Budget and Milestone Tables) The outreach phase is ongoing throughout the 21-month contract time frame, with approximately 10 hours per month dedicated to coordination and project implementation.

Task 2 Outputs: Contractor will track the number of participants attending the public meetings and field tour to gauge the effectiveness of the outreach efforts. Material handed out at the meetings and tour will include electronic copies of the results of this modeling project, an executive summary and the revised Lower Ruby Valley Groundwater Management Plan. At least two public meetings, one watershed tour and five RWC meetings will be completed. All products and handouts, including meeting agendas, sign-in sheets and presentation materials will be included as a part of the final report detailed in Section 1.0 SERVICES of this agreement. . All documents in both hard copy and electronic format must comply with the Water Quality Planning Bureau (WQPB) Document Requirements incorporated into this agreement as Attachment C.

Task 2 Acceptance Criteria: The RVCD and RWC will continue to work closely together to unite the stakeholders in the watershed. An increase in public participation and WQRP project implementation are indicators of a successful outreach and education program. Submission of the Final Report and Products from Task 1 of this agreement in a timely fashion. All documents in both hard copy and electronic format must comply with the Water Quality Planning Bureau (WQPB) Document Requirements incorporated into this agreement as Attachment C.

TASK 3: ADMINISTRATION

Task 3 Description: The RVCD administrator (Shirley Galovic) will manage the project under direction from the RVCD Supervisors. The RVCD and RWC will oversee the project team, resources and education efforts to efficiently and effectively complete this project.

Contract Administrative Training: Contractor will send one person to attend a two-day training conference. The conference will include training on procurement, contract administration, contract management, accounting techniques, match reporting and tracking, and report writing.

Task 3 Cost: 319 \$6,600.00

Task 3 Outputs: Timely submission of status reports; provide project leadership and communication; coordinate and facilitate meetings; monitor project schedule and track project budget.

Task 3 Acceptance Criteria: Submission of all Status, Annual and Final reports in a timely fashion as detailed in Section 1.0 SERVICES of this agreement. Submission of invoices and support documentation to DEQ that utilizes Generally Accepted Accounting Principals on Attachment B of this agreement. All documents in both hard copy and electronic format must comply with the Water Quality Planning Bureau (WQPB) Document Requirements incorporated into this agreement as Attachment C.